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BIENNIAL REPORT

OF THE

RAILROAD COMMISSION OF WISCONSIN

FROM JULY 1, 1918, TO JUNE 30, 1920

CARL D. JACKSON, *Chairman*
HENRY R. TRUMBOWER
JOHN S. ALLEN

C. D. SECHEVERELL, *Secretary*

MAR 2 1921

Madison, Wisconsin
1920

HJ

Madison, Wisconsin, August 31, 1920.

To His Excellency Emanuel L. Philipp, *Governor:*

As required by law, we have the honor to submit our report of receipts and disbursements and other matters pertaining to this office for the biennium ended June 30, 1920.

RAILROAD COMMISSION OF WISCONSIN,

Carl D. Jackson,

Chairman.

INTRODUCTORY

The work of the Commission for the period covered by this report is marked by two general characteristics, first, the relatively small number of cases involving the railroads, because of their being under Federal control; second, the excessively large number of utility cases handled, most of them involving increases in rates due to the abnormal economic conditions created by the war. These conditions, and their effect on the utilities. are discussed at length in the report. The affairs of the Commission have been subjected to the same influence which is reflected in the cost of conducting its business. The number of formal cases handled by the Commission has shown a progressive increase, as indicated by the table of cases filed for each six-months' period covered by this report:

For the six months ended	December	31, 1918	216
" " " " "	June	30, 1919	295
" " " " "	December	31, 1919	405
" " " " "	June	30, 1920	506

In spite of being handicapped by the lack of adequate staff personnel, decisions rendered have kept pace with new cases filed. There were 278 open cases on the docket July 1, 1918, and 285 open on June 30, 1920, an increase of only 7 for the two-year period. Of the pending cases, 154, or more than half, were filed since May 1.

During the month of June, 1920, there were 93 cases set for hearing, which compares with only 406 set for the entire year 1916. There has been no suspension of hearings during the months of July and August, as was formerly the practice. While no prediction can be made for the future, it is hoped that the peak has been reached. However, any present decrease in the number of utility cases arising will be more than offset by the increase in railroad cases that will follow the resumption on September 1 of full private control and operation. Moreover,

as soon as market conditions begin to show a downward tendency there will be an increase in utility cases involving decreases in rates.

The questions brought before the Commission cover a wide range of subjects and arise from every part of the state. Their diversity is shown by the following partial list of the character of complaints handled. Complaints involving steam railways involve right-of-way fences, farm crossings, drainage, car shortage, depot facilities, condition of stock yards, stopping of trains, delayed shipments, demurrage charges, damage claims, freight overcharge claims, spur tracks, switching service, telephones in depots, crossing protection. Complaints against utilities include refusals of service, overcharge on bills, classification of consumers, street-car transfers, extension of mains, adequacy of water supply, interruption of service, physical connection between telephone exchanges, night service for telephones, discontinuance of service, and many others.

In this report the financial affairs of the Commission are set forth in detail, followed by a general statement of the activities of each department concerned with the regulation of railroads and utilities. The reports of the departments charged with the administration of the Investment Securities Act and the Rent Regulation Act will be separately published.

FINANCIAL STATEMENT

RECEIPTS

For	1918-19	1919-20	Total
Stock and bond fees	$4,123.50	$12,680.60	$16,804.10
Water-power fees	3,316.35	506.95	3,823.30
Meter testing	28.00	11.00	39.00
Sale of publications	236.65	308.68	545.33
Total	$7,804.50	$13,507.23	$21,211.73

The stock and bond fees are paid into the common-school fund of the state, the water-power fees are added to the appropriation for the administration of the water-power law, all other receipts are paid into, and become a part of, the general fund of the state.

DISBURSEMENTS

For	1918-19	1919-20	Total
Salaries	$133,098.25	$151,695.74	$284,793.99
Traveling expenses	15,544.35	19,348.57	34,892.92
Stationery and office supplies	2,247.26	2,374.84	4,622.10
Printing	7,919.27	3,824.48	11,743.75
Postage, telephone and miscellaneous	5,029.02	6,387.77	11,416.79
Total general administration	$163,838.15	$183,631.40	$347,469.55
Water power	16,450.14	14,939.52	31,389.66
Total	$180,288.29	$198,570.92	$378,859.21

The appropriation for water-power administration is $15,000 per year, plus all fees received. The appropriation for general administration was $170,000 for the year ended June 30, 1919, and $185,000 for the year ended June 30, 1920. The appropriation for the year ended June 30, 1921, is $185,000, and there was on hand July 1, 1920, unexpended from prior appropriations $16,701.34, making a total of $201,701.34 available for the current fiscal year. Expenses for the month of July indicate a probable monthly average in excess of $17,000, which will just about exhaust the appropriation by the close of the fiscal year.

STOCK AND BOND DEPARTMENT

During the war period the demands of the government upon the capital resources of the nation made necessary the curtailment of utility expansion and caused the postponement of all but the most urgent of betterment programs. The flow of capital into public utility enterprises came almost to a standstill. This in spite of the fact that to adequately fulfill their public functions the utility must expand with the growth of the community served and be ever ready to finance the extensions and improvements required to enable them to maintain the high standards of service to which the people of this country have become accustomed.

During the year ended June 30, 1916, the Commission authorized security issues by public-utility corporations to the amount of $125,846,883. For the year ended June 30, 1918, the amount authorized had decreased to $24,074,500. The amounts authorized during the two years covered by this report are shown by the following table, classified as to kinds of securities issued.

For Years Ended June 30

	1919	1920
Common stock	$883,592	$5,381,843
Preferred stock	1,040,600	3,372,600
Bonds	16,708,000	39,785.233
Notes	5.494,000	11.098,075
Equipment trust certificates	....	32,127,109
Total	$24,126,192	$91,764,860

An interesting development in the financing of public utilities is shown by the increasing proportion represented by stock issues. In 1916, stock issues amounted to only 2.1 per cent of the total, while for the year ended June 30, 1920, stock issues represent more than 18 per cent of the permanent financing. Practically all of this stock has been sold locally by the utilities to their customers. It should also be noted that there has been a large amount of temporary financing by the issue of notes and other short-term securities. This has been due to the desire of the utilities to avoid putting out long-term securities at the abnormally high rates of interest that have prevailed during the preceding two years. We submit a list of the more important issues, those involving $100,000 or more.

Public Utilities

Company	Stock	Bonds and Notes
Eastern Wisconsin El. Co.	....	$760,000
Ironwood & Bessemer Ry. and Lt. Co.	....	350,000
Chicago, North Shore & Milw. R. R.	....	755,000

Public Utilities (Continued)

Company	Stock	Bonds and Notes
Central Wisconsin Utilities Co	$100,000	$293,000
Eastern Wisconsin El. Co	383,500	885,000
Wisconsin Tr. Lt. Ht. and Pr. Co	....	1,000,000
Clintonville Power Co	190,000	100,000
Interstate Power Co	817,200	488,000
Milwaukee Lt. Ht. and Tr. Co	....	4,500,000
Milwaukee El. Ry. and Lt. Co	....	3,600,000
Clintonville Power Co	145,000	150,000
Waukesha G. and El. Co	....	115,000
Wisconsin River Power Co	....	176,000
Ironwood & Bessemer Ry. and Lt. Co	....	687,000
Interstate Power Co	....	100,000
Peninsular Power Co	100,000	....
Milwaukee Northern Ry. Co	....	102,500
Wisconsin Valley El. Co	250,000	....
Wisconsin River Power Co	....	1,124,000
Chicago, North Shore & Milw. R. R	....	1,150,000
Eastern Wisconsin El. Co	187,000	573,000
Wisconsin Pr. Lt. and Ht. Co	....	150,000
Big Falls Power Co	750,000	3,000,000
Wisconsin Tr. Lt. Ht. and Pr. Co	....	1,000,000
Wisconsin-Minnesota Lt. and Pr. Co	....	184,500
Wisconsin-Minnesota Lt. and Pr. Co	....	125,000
Big Falls Water Power Co	1,000,000	....
Eastern Wisconsin El. Co	1,900,000	998,000
Colfax Lt. and Pr. Co	182,900	....
Wisconsin River Power Co	500,000	....
Wisconsin Valley El. Co	350,000	....
Peninsular Power Co	250,000	....
Peninsular Service Co	100,000	....
Interstate Power Co	92,800	180,000
Eastern Wisconsin El. Co	383,500	1,200,000
Wisconsin G. and El. Co	500,000	500,000
Wausau Tel. Co	160,000	....
Rhinelander Lt. and Pr. Co	....	113,000
Wisconsin Pr. Lt. and Ht. Co	....	130,500
The Milwaukee El. Ry. and Lt. Co	....	2,000,000
Madison G. and El. Co	600,000	....
Wisconsin Pr. Lt. and Ht. Co	....	250,000
Beloit Water, G. and El. Co	1,000,000	....
Peninsular Service Co	....	300,000
Wisconsin Valley El. Co	200,000	....
Wisconsin-Minnesota Lt. and Pr. Co	....	200,000
Wisconsin G. and El. Co	....	500,000

Steam Railroads

Company	Stock	Bonds and Notes
Chicago, St. P. M. & O. Ry. Co	....	$700,000
Chicago, St. P. M. & O. Ry. Co	....	6,070,000
Wisconsin & Northern Ry. Co	....	7,000,000
Wisconsin & Northern Ry. Co	....	1,600,000
Chicago & N. W. Ry. Co	....	800,000
Chicago & N. W. Ry. Co	....	9,974,875
Chicago, M. & St. P. Ry. Co	....	16,760,000
Chicago, St. P. M. & O. Ry. Co	....	2,352,300
Minneapolis, St. P. & S. S. M. Ry. Co	....	500,000
Northern Pacific Ry. Co	....	4,500,000
Minneapolis, St. P. & S. S. M. Ry. Co	....	2,500,000
Chicago & N. W. Ry. Co	....	15,000,000

STATISTICAL DEPARTMENT

G. C. MATHEWS

Judged by the experience of the Department prior to 1918, the last two years may be said to have been decidedly abnormal. Conditions arising out of the war, which had their effect on every business organization in the country, also had a very marked effect upon the work of the Commission, and especially of the Statistical Department. Among the conditions which were abnormal during the biennium just past the principal ones were the following:

(1) The Practical Cessation During a Part of the Period of Railway Cost Analyses

Up to the time of the taking over of the railroads by the Government, the Commission had continuously maintained a small force whose duties were to keep up the work of analysis of railway costs in order that the various rate cases might be based upon the results of operation and the cost of service. During the time that the railroads were under Government control the work of the Commission along this line was almost suspended, and the staff employed on railroad work was reduced to a minimum, only such work being kept up as would be necessary as a foundation for the rate work of the Commission upon the return of the railroads to private ownership.

With the end of the period of Government operation the staff employed on railway statistical work has been partially restored, and at the present time it appears that a great deal of work dealing with railway costs must be done within the next two or three years.

(2) The Abnormal Amount of Public Utility Work

On account of the extreme increase in the cost of conducting the utility business since 1917, there has been a great number of cases before the Commission dealing with adjustments of utility rates. During the year ended June 30, 1919, reports were prepared in the Statistical Department relative to 180 public-utility and electric-railway rate cases. During the year ended June 30, 1920, reports were prepared on 292 cases, including 33 electric-utility cases, 16 gas-utility cases, 226 telephone-utility cases, 11 involving water-utility rates, and 6 affecting street-railway rates. In number, the reports prepared in the Department during the past two years were several times as great as during any corresponding previous period.

(3) The Inadequacy of the Departmental Staff

The amount of work to be handled increased so greatly over any amount in the experience of the Commission that it has been only with the greatest difficulty that the Commission has been able to maintain an adequate force within the limits of its appropriation. In fact, at practically all times there has been a shortage of help in the Department, which has emphasized the fact of the abnormal amount of work in utility rate cases.

(4) The Difficulty of Retaining Employes

In common with every organization of which we have any knowledge, the Commission found it necessary to make rather substantial changes in salaries, but even with such changes it has not been possible to keep continuously in the employ of the Commission more than a few members of the Departmental Staff. In June, 1920, the Statistical Department consisted of 21 employes, which is a smaller number of employes than the average number employed during several of the pre-war years. To maintain an average staff of about 21 employes during the biennium it was necessary to employ, in all, 42 people at some time during the two-year period. Only six of the employes of the Department during June, 1920, were continuously in its employ during the biennium. Twelve employes left the Department to go directly to positions paying better salaries than the Commission could afford to pay. Three left during this period to go into military, naval, or Red Cross service, one employe was transferred to another department of the Commission, two were released temporarily in order to do other work, three left for reasons not related in any way to their employment, and two were dropped. Attempts have been made to re-employ a number of former employes of the Department, but without success. In practically every case employment in positions obtained after leaving the Department has been more attractive, financially, than anything that the Commission could offer. In the case of two employes who were granted leave of absence to do other work for short periods, the Commission considered it necessary to grant such leave in order that the earning power of the employes might be brought more nearly to what it would be in outside work, and the Commission feels that it is only by granting leave of absence in meritorious cases that it will be able to keep its organization, as long as present conditions prevail. That this problem of employes leaving for other positions has not been peculiar to the last biennium is indicated by the general experience of the Commission. At the present time there are four men in the Statistical Division whose entire time is given to the preparation of reports in the various public-utility rate cases. An examination of the pay rolls of the Statistical Division for the past 10-year period shows that during that period in order to keep up an average staff of from 4 to 6 men working on reports in rate cases, a total of 16 investigators has been employed by the Commission, and of these 12 have left the employ of the Commission, in each case entering employment of a more lucrative character.

The difficulties in keeping up the personnel of the Department do not relate entirely to the retention of employes in the service. It has become increasingly difficult to obtain help, and of course impossible to do so at anything approaching salary scales formerly in effect.

Notwithstanding this, the Department has been able to render its reports to the Commission with a fair degree of promptness. An analysis of the record of reports made to the Commission in the various rate cases shows that for the last half of 1917, 40 per cent of the reports were made within one month of the reference of the cases to the Statistical Department, 70 per cent were made within two months, and 90 per cent within three months. For 1918, 36 per cent of the reports were made within one month, 62 per cent within two months, and 81 per cent within three months, while for 1919, these percentages were, respectively, 25 per cent, 72 per cent, and 92 per cent. This record of elapsed time includes all the time from the reference of the cases to the Statistical Department to the return of the completed departmental report to the Commission. Those cases which have required over three months for preparation of the report have, in practically every instance, been cases where the departmental report had to be delayed on account of information required which was not immediately available.

At the time of the compilation of this report there are more cases awaiting reports from the Statistical Department than at any other time in the history of the Commission. The record shows, however, that, except for a number of applications of the Wisconsin Telephone Company for authority to increase rates, which were filed in May, practically all of the cases now awaiting reports on September 1 had been filed since June 1, and of the Wisconsin Telephone Company cases, those which were filed prior to June 1 had been held in order that the record in other cases involving the same company might be completed and the work handled at the same time.

Reference has been made above to some of the problems with which the Department has been confronted, and we do not believe it necessary to elaborate further on these for the reason that they are problems such as every concern has been confronted with during the past two or three years. It will probably be in point at this time to call attention to the various phases of the work which the Statistical Department has undertaken. In previous reports we have outlined quite fully the nature of the Department's work in checking up reports filed by utilities, in checking the rate schedules as filed, and keeping a record of the rates lawfully in effect for the various utilities, and of the work in connection with the presentation of reports dealing with the various rate cases.

During the year 1917 the accounting section of the Department was re-organized and an experienced certified public accountant placed in charge and since that date the Department has been in a greatly improved position relative to its auditing work. The first audit of the Milwaukee Electric Railway and Light Company was completed early in 1918, and shortly thereafter an audit of the Wisconsin–Minnesota Light

and Power Company, covering its property accounts from the date of organization and its operating results for the year 1917, was undertaken. This work was handicapped very greatly by changes in the personnel of the accounting staff while the work was in progress. On the average, a staff of three or four men was maintained on this job, but in order to keep such a staff working on the job it was necessary to employ during its course a total of 13 accountants. The personnel of the staff making the audit changed almost completely twice during the course of the job. In almost all cases this was due to the fact that accountants employed on the work left the Commission to take better positions.

The verification of all the construction expenditures and of the operating accounts for a year proved a much greater job than had been anticipated at the time the work was undertaken, but the audit report has been completed, and the Commission now has available a completed detailed record of the property account of the company up to the end of 1917.

During the last two years a number of partial audits, covering certain phases of the accounts, have been made of the books of the Milwaukee Electric Railway and Light Company, and the field work has been completed on an audit of the books and records of the Milwaukee Gas Light Company. In addition, a number of special jobs have been undertaken in connection with the administration of the Stock and Bond Law which did not require complete audits.

Since January 1, 1920, we have found it possible to secure some additional help which was not available during the war, and two employes have been assigned the auditing work in connection with the smaller public-utility cases. It has been found that the reports filed with the Commission by the smaller public utilities are quite frequently inaccurate, due, partly, to a misunderstanding of accounting methods on the part of officials of the company, and, partly, to the fact that the importance of keeping proper accounts has not been fully appreciated. Since this work was undertaken early in the spring of 1920, investigations have been made of the books of 25 of the telephone companies in the state, which investigations have served to furnish the data necessary in connection with applications to increase rates, and have also furnished us with accurate reports of the operating results of the smaller companies, which are valuable as indicating the unit cost of carrying on business of this class. It is hoped to continue this work, at least until a substantial proportion of the utilities in the state have been covered.

All utilities in the state are required by law to make reports to the Commission. In the original law these reports were required to be for fiscal years ended June 30. In 1913 this law was changed so that the reporting year for telephone companies was made December 31, and the 1919 Legislature further amended the law to make the reporting year the calendar year for all companies. In 1908, the Commission prepared its Uniform Classification of Accounts, by which utilities were

to be guided in keeping their records on a uniform basis, and from which reports to the Commission were to be made. The general structure of this classification has stood the test of actual experience, but it was not sufficiently elastic to meet all the requirements. The original classification divided utilities into three classes, the lowest of which required altogether more in the way of accounting detail and accounting ability than the smallest utilities were prepared or able to furnish. Later, two additional classes were added for the smaller utilities, the last of which includes such utilities as can reasonably furnish only the most condensed reports of receipts and disbursements and property accounts, but even this grouping has been found to be inadequate as applied to some of the very smallest utilities in the state, which are principally the roadway telephone companies, sometimes consisting only of a single line with 10 or a dozen telephones connected, and from these the report which the Commission obtains consists of a single page, giving general descriptive data as to the system.

The Public Utilities Law contemplates that every utility shall keep a double-entry set of books, but in actual practice this has been found to be absolutely unworkable. No matter what the law provides as to the books to be kept, many of the utilities are unable to keep a double-entry system, and their financial condition is not such as to warrant the expense of employing a bookkeeper for a business of very small size. Furthermore, for the smaller utilities, the advantages to be obtained from a double-entry system of bookkeeping are negligible, and we have in mind the preparation of a form of report for the smaller companies which will recognize the impossibility of keeping records on a plan uniform, even in its basic principles, with that adopted for the larger companies, but which will furnish all the information necessary for the administration of the Public Utilities Law relative to rates for service rendered.

The Department also has in preparation a pamphlet dealing with the proper accounting for depreciation, which it is planned to issue within a short time. It is hoped that this pamphlet will clear up many of the confusing situations with which utilities have been confronted, and enable some degree of uniformity of practice to be followed in one of the most important features of the classification of accounts which was not adequately covered by the original classification.

At the present time a committee of the National Association of Railroad and Utility Commissioners, of which the head of the Statistical Department of this Commission is a member, is working with representatives of the national gas and electrical associations on uniform classifications with a view to preparing classifications which can be recommended to the various state commissions for adoption. It is believed that this committee will be ready to make a final report before the end of 1920.

DEVELOPMENT OF PUBLIC UTILITIES

The most noteworthy feature in the development of public utilities in recent years has been the tendency toward consolidation of utilities operating in neighboring cities and villages, particularly in the case of electric utilities where central-power plants have to a large extent superseded the individual plants, and energy is transmitted for relatively long distances over high-tension lines. However, the consolidation of utilities has not been confined to the electric utilities. We have made a summary of consolidations as shown by the files of the Department. The following statement shows in the first column the name of the company at present operating the properties, and in the second column, the properties which have been acquired during the period in which reports have been made to the Commission. In some cases these properties which have been acquired had in turn acquired others, but we are showing here only the transfers which resulted in the present organization.

TELEPHONE UTILITIES

Present Operating Company	*Properties Acquired*
Wisconsin Telephone Co.	Beloit Home Tel. Co. Citizens Tel. Co., Racine Fox River Valley Tel. Co. Evansville Tel. Co. Kenosha Home Tel. Co. Mazomanie Tel. Co. Waushara Tel. Co. Ashland Tel. Exchange Bayfield Farmers Tel. Co. North Wisconsin Toll Line
Peoples Telephone Co. of Rio	Cambria Cooperative Tel. Co.
Fond du Lac Rural Tel. Co.	Eldorado & Friendship Tel. Co. Empire Tel. Co. Woodhull Tel. Co.
Markesan Telephone Co.	Fairwater Tel. Co. Green Lake Tel. Co.
Ozaukee-Washington Tel. Co.	Freistadt & Cedarburg Tel. Co. Grafton Tel. Co. Mequon Tel. Co.
Cazenovia Telephone Co.	Westford Tel. Co.
Dekorra Farmers Mutual Tel. Co.	Poynette Farmers Mutual Tel. Co.
Independence Telephone Co.	Farmers Independent Tel. Co.
Logansville Telephone Co.	Loretta & Logansville Tel. Co.
Boyd & Sons Telephone Co.	McCartney & Sons Tel. Co.
Mishicot Telephone Co.	Larrabee Tel. Co.
Plain Telephone Co.	Troy & Honey Creek Tel. Co.
Platteville Rewey & Ellenboro Tel. Co.	Grant Co. Telegraph & Tel. System
Tomah Telephone Co.	Geo. Warren Co.
Mt. Vernon Telephone Co.	Pine Bluff Tel. Co.
Newburg Telephone Co.	Port Washington Tel. Co.
Pittsville Telephone Co.	Progress Tel. Co.
Hubertus Telephone Co.	Richfield, Hubertus & Holly Hill

Telephone Utilities (Continued)

Present Operating Company	*Properties Acquired*
Ripon United Telephone Co	Ripon Rural Tel. Co. Ripon Tel. Co.
Pierce County Telephone Co	Roberts Tel. Co.
Reedsburg Telephone Co	Rudd & Rood Tel. Co.
Baldwin Telephone Co	Rush River–Eau Galle Tel. Co.
Gilman & Western Telephone Co	Stanley & Northern Tel. Co.
Clark County Telephone Company	Abbotsford El. Lt. and Tel. Co. Loyal Telephone Exchange Co. C. H. Taylor Tel. Co. Colby Tel. Co.
Random Lake Telephone Co	Adell Tel. Co.
Colfax Telephone Co	The O. I. Anderson Tel. Co.
Rock County Telephone Co	Badger Tel. and Telegraph Co.
Oconto Rural Telephone Co	Robert C. Faulds Tel. Co., Abrams
Grand River Telephone Co	Kingston Tel. Co. Schwandtke & Zuelsdorf Tel. Co.
Boyceville Telephone Co	Hay River Farmers Mutual Tel. Co.
So. Alma Farmers Telephone Co	Hixton & Alma Center Farmers Tel. Co.
Muscoda Telephone Co	Hoosier Hollow Tel. Co. Muscoda Mutual Tel. Co.
Ladoga–Oak Center Telephone Co	Lamartine & Rock River Tel. Co.
Suring Telephone Co	Linzy Brook Tel. Line
United Telephone Co., Monroe	Monroe Tel. Co. Pagel Tel. Co.
Pulaski Merchants & Farmers Tel. Co.	Oconto County Tel. Co.
Eagle River Telephone Co	Oneida & Vilas County Tel. Co.
Wise Telephone Co	Stone Lake Tel. Co. Birchwood Tel. Exchange
Midway Telephone Co	Trade Lake Rural Tel. Co.
Tomah Electric & Telephone Co	Tunnel City Tel. Exchange
La Fayette Telephone Co	White Oak Tel. Co.
Colburn Mutual Telephone Co	Yellow River Tel. Co.
Mattoon Telephone Co	Aniwa Tel. Co. Birnamwood Tel. Co.
Richland Telephone Co	Badger Tel. Co.
New Union Telephone Co	Barneveld & Ridgeway Tel. Co.
Bashaw Valley Telephone Co	Shell Lake Tel. Exchange
Alliance Telephone Co	Bond Lake Mutual Tel. Co. Lake Nancy Tel. Co.
Washington County Telephone Co	Cedar Lake Tel. Co.

Other Public Utilities

Present Operating Company	*Properties Acquired*
Wisconsin–Minnesota Lt. and Pr. Co.	Thorp Municipal Light Dept. Alma Electric Light Co. Wisconsin Log and Mfg. Co. Chippewa Valley Ry. Lt. and Pr. Co. Ellsworth Ht. Lt. and Pr. Co. Inter County Lt. and Pr. Co. N. C. Foster Lumber Co. La Crosse G. and El. Co. Mondovi Lt. and Pr. Co.

OTHER PUBLIC UTILITIES (Continued)

Present Operating Company	*Properties Acquired*
Wis.-Minn. Lt. and Pr. Co. (Cont.).	Neillsville El. Co.
	Red Cedar Valley El. Co.
	O. I. Newton's Sons Co.
	Spring Valley Lt. and Pr. Co.
	Northwestern Lumber Co.
	Viroqua El. Lt. Co.
	Cochrane El. Lt. and Pr. Co.
	Eau Claire Gas Light Co.
Wisconsin Power, Light & Heat Co.	Beaver Dam Lt. and Pr. Co.
	Berlin Public Service Co.
	Central Wisconsin Ry. and Util. Co.
	Mineral Point Pub. Service Co.
	Fox Lake Light and Power Co.
	Horicon Light and Power Co.
	Neshkoro Light and Power Co.
	Omro Electric Light Co.
	Portage Electric Lt. and Pr. Co.
	Baraboo Gas and Electric Co.
Wisconsin Gas and Electric Co....	Ruplinger-Weiss Hardware Co.
	Burlington El. Lt. and Pr. Co.
	Campbellsport El. Lt. and Pr. Co.
	Eden Electric Light Co.
	Iron Ridge El. Lt. and Pr. Co.
	Kenosha Electric Railway Co.
	Lomira El. Lt. and Pr. Co.
	Marshall El. Lt. and Pr. Co.
	Menomonee Falls El. Lt. and Pr. Co.
	Reeseville Ht. Lt. and Pr. Co.
	South Germantown Electric Co.
	Theresa El. Lt. and Pr. Co.
	Thiensville Light and Power Co.
	Watertown Gas and Electric Co.
	C. H. Murdock Electric Co.
	Union Grove Electric Co.
	Racine Gas Light Co.
Southern Wisconsin Electric Co....	United Heat, Light and Power Co.
	Equitable Electric Light Co.
	Sharon Municipal Electric Plant
	Walworth Lighting Plant
The Milwaukee El. Ry. and Lt. Co..	Commonwealth Power Co.
	Plankinton El. Lt. and Pr. Co.
	New Butler Electric Light Co.
	Pewaukee Electric Co.
	Continental Realty Co.
	Milwaukee Lt. Ht. and Tr. Co.
Wisconsin Improvement Co........	Osceola Electric Light Co.
Oconto Service Co................	Peshtigo Lumber Co.
Interstate Light and Power Co.....	Platteville El. Lt. and Pr. Co.
	Apple River Power Co.
	St. Croix Gas Co.
Central Wisconsin Utilities Co.....	Ripon Light and Water Co.
	Markesan Electric Co.
	Green Lake Electric Co.
	Wisconsin Lt. Pr. and Mill. Co.
Wisconsin Ry. Lt. and Pr. Co......	La Crosse Water Power Co.
	La Crosse City Railway Co.
	Winona Railway and Light Co.

OTHER PUBLIC UTILITIES (Continued)

Present Operating Company	*Properties Acquired*
Wisconsin Valley Electric Co.	Merrill Railway and Light Co.
	Mosinee Electric Co.
	Stevens Point Lighting Co.
	Stevens Point Power Co.
	Wausau Street Railway Co.
Eastern Wisconsin Electric Co.	Eastern Wisconsin Ry. and Lt. Co.
	Sheboygan Ry. and El. Co.
	Wisconsin Electric Railway Co.
Frederick Electric Light Co.	Dahlberg Bros. Light Plant
Milwaukee Lt. Ht. and Tr. Co.	Waterford Milling and Light Co.
Wisconsin Public Service Co.	Green Bay Gas and Electric Co.
	Minahan Building Co.
	Northern Hydro-Electric Plant
	West Side El. Power and Ltg. Co.
	Green Bay Traction Co.
Lake Mills Mun. Water & Light Co.	Fargo Creamery Supply House
Apple River Milling Co.	Amery Electric Co.
	Clear Lake Electric Co.
Ironwood & Bessemer Ry. & Lt. Co.	Ashland Power Co.
Augusta Light and Telephone Co.	J. L. Ball El. Lt. and Pr. Co.
Burkhardt Milling & El. Pr. Co.	Baldwin El. Light and Fuel Co.
	Willow River El. Lt. and Pr. Co.
Fish, Chas. W., Lumber Co.	Birnamwood Electric Light Co.
	Forster-Mueller Lumber Co.
Janesville Electric Co.	Edgerton Electric Light Co.
Badger Public Service Co.	Elkhart Lake Light and Power Co.
River Falls Power Co.	Clifton Light and Power Co.
Rhinelander Light and Power Co.	Crandon Municipal El. Dept.
	Rhinelander Lighting Co.
	Rhinelander Power Co.
John S. Owen Lumber Co.	Withee Electric Light Co.
Wisconsin Valley Utilities Co.	City Lighting Co., North Freedom
Bark River Electric Service Co.	Bark River Light and Power Co.
	Helenville Light and Power Co.
Madison Railways Co.	Southern Wisconsin Railway Co.
Chicago, North Shore & Milw. R. R.	Chicago & Milwaukee El. R. R. Co.

In the foregoing list a few of the changes noted practically amount merely to changes in name, but the summary presented will be significant as indicating the tendency toward consolidation.

GROWTH OF BUSINESS

The growth of the business of the public utilities in the state may be judged principally by three standards: (1) The investment as shown by the property and plant accounts of the utilities, (2) the total revenue obtained from the utility service, and (3) by the number of customers served. The figures, as presented here, are taken from the compilations of the reports filed with the Commission, and show clearly the remarkable growth of the utility business during the past 10 years.

INCREASES IN PROPERTY

In the electric business the plant value for all the utilities in the state, as reported to the Commission in 1910, amounted to $30,886,269.

By 1914 this had increased to $38,903,853, and by 1919 to $93,959,495. Operating revenues showed a similar rapid growth. In 1910 they amounted to $4,443,930. In 1914, the revenues were $8,013,844, and in 1919 they had increased to $16,931,468.

The gas utilities showed a steady growth, but not in any such proportion as obtained in the electric business. In 1910, the combined property and plant accounts of the gas utilities in the state amounted to $24,149,734, which had increased to $27,303,741 by 1914, and to $30,869,929 by 1919. Operating revenues for the gas industry in 1910 were $4,009,205, in 1914 they reached a total of $5,002,909, and in 1919 they amounted to $7,896,525. It will be noted that in the gas business the increase in revenues from 1910 to 1919 was considerably more rapid than the increase in property and plant. This was due, to a considerable extent, to the fact that increasing costs in the gas business had made it necessary to increase rates by 1919 so that for a given volume of gas sold there was a larger revenue than in 1910. In the gas business, however, the amount available for return upon their investment increased only from $1,387,173 in 1910 to $1,667,194 in 1914. The next two years showed slight increases in the amount available for return, but in 1917 and 1918 the amount declined, and in 1919, even with an increase of about $3,500,000 in plant investment over the investment in 1914, the amount available for return was only $1,571,772, or almost $100,000 less than in 1914.

The business of the water utilities in the state has also shown a growth, although here, too, the rate of growth has been less rapid than in the electric business. Naturally, the electric business and the telephone business, being of more recent development, have shown greater rates of growth than have obtained in the older forms of utilities such as those supplying gas and water service. The plant investment of the water utilities in the state in 1910 amounted to $21,938,979, in 1914 to $26,658,835, and by 1919 this had been increased to $33,850,167. The operating revenues for 1910 amounted to $2,170,633, and for 1914 to $2,867,401. In 1915 there was a decline in revenue, followed by an increase in 1916 and 1917. The year 1918 again showed a decline, but by 1919 revenues had increased to $3,864,151. It is of interest to note that while the total revenues of the water utilities of the state increased about $1,700,000 from 1910 to 1919, the amount which was available for return, after operating expenses, increased a little less than $200,000. Over 85 per cent of the increased revenue was absorbed by the increased operating expenses.

Between 1910 and 1919 the amount invested in the telephone business in the state just about doubled. The increases were from an amount of $14,944,892 in 1910 to $21,698,924 in 1914, and to $29,342,772 in 1919. Operating revenues increased a little more than 100 per cent during this period, growing from $4,171,186 in 1910, to $9,176,576 in 1919. However, the amount which the companies had available for return on their investment increased only about 40 per cent. In 1910, the total was $1,018,407, and by 1919 it had increased to only $1,411,226, although in intermediate years the total was higher. The effect of the very

rapid increase in operating expenses is clearly shown in the net revenues for the year 1919.

The electric railways also showed an increase in investment and in revenues, although the increase here was not as rapid as in the case of the electric utilities. The property and plant accounts in 1910 totaled $51,148,324, and in 1919 the total was $84,714,942, or an increase of about 65 per cent. Operating revenues show the effect of increased rates of fare, many of which were effective during 1919. The total operating revenues amounted to $8,823,966 in 1910, and to $15,784,993 in 1919. Although the operating revenues show an increase in greater proportion than the increase in investment, the total operating expenses increased at an even greater rate, and the amount available for return upon the property showed a decrease between 1914 and 1919. Between 1910 and 1914 the amount available for interest, dividends, and surplus increased from $3,343,618 to $3,678,504, but in 1919 it was only $3,048,547, or about 8 per cent less than in 1910.

The heating utilities of the state, although of great importance in the communities served, are, when judged by the magnitude of the other utilities, relatively insignificant. The total property and plant accounts of the heating utilities in 1910 was $1,040,857, and by 1919 this had increased to $2,167,865. The revenues for 1910 were $232,468, and for 1919 they were $783,166. The increase in revenues was at a much more rapid rate than the increase in investment, but it should be remembered that the principal element in the cost of furnishing heating service, aside from the fixed charges, is the cost of coal, and that increases in rates had been necessary in order to enable the utilities to pay the increased prices of coal and have anything available for return. In 1910, $46,877 was available for return on investment, and in 1919 $83,574, which is approximately 4 per cent of the amount shown in the plant accounts.

It may be of interest, also, to note the number of customers served by those utilities whose business is such that a record of individual customers is available. In 1910 there were only 54,654 users of electric energy in the state, but by 1919 the number was practically four times as great, being 214,931. In the gas business the increase was from 125,826 in 1910 to 207,895 in 1919. During this period the electric business grew from a position in which it served less than half the number of customers who were served by the gas business to a position in which it served a greater number than the total number of users of gas service.

The records as to the number of users of water service are not so satisfactory, due to the fact that many of the smaller municipal plants have not made thorough reports, but the figures which the Commission has indicate a growth in the number of water users from 141,261 in 1910 to 223,570 in 1919.

There are more users of telephones in the state than of any other class of utility service. This, of course, is largely due to the fact that the telephone utility, until very recently, has been the only one supplying service in rural communities, and that practically every village in

the state is supplied with telephone service. With the development of the electrical transmission systems it is not unreasonable to look ahead to the time when the users of electric service will approach in number the users of telephone service, but the nature of the gas and water business is such that they cannot be expected to reach any such number of customers.

OPERATING RATIO

The ratio of total operating expenses to total revenues, that is, the number of cents of each dollar of revenue which is required to meet the expenses of carrying on the business before anything is allowed for a return on the investment, is one measure of the success with which the business is conducted, and helps to show the financial strength or weakness of the company. The war period had a very serious effect on the operating ratio of some of the utilities. In general, the gas and electric-railway companies felt the effects of the war more seriously than other companies. The gas companies were affected primarily by the enormous increase in the price of coal, which constitutes a large part of the total cost of furnishing gas service. The electric railways were affected by the increase in the cost of coal in the case of those railways which used steam power for generating energy, and by increases in labor cost, since a large part of their total expenses consists of the cost of platform labor. In the gas and electric-railway business, the increased industrial activity during the war did not, in most cases, add materially to the revenues of the utilities. Many of the electric utilities had their revenues increased very materially by the increase in business resulting from industrial activity, but it was not until the close of the war that the electric railways showed any marked increase in business, and there has been no unusual tendency developed, as yet, in the gas business.

In the telephone business, the ratio of expenses to revenues was affected directly by the application of the living-wage law, under which a minimum wage for female employes was made effective August 1, 1919. However, in the reports which have been filed with the Commission up to the present time, the effect of this increase is not fully shown, as it was effective for only five months of 1919.

In the gas business, the operating ratio in 1914 was 68.8 per cent, and 1916 showed the smallest operating ratio of any year of which we have record, when it was only 64.3 per cent, that is, 64.3 cents out of each dollar of revenue was required to meet the operating expenses. Since 1916 there has been an increase each year in the operating ratio, and the year 1919 showed a ratio of 81.46 per cent. Since the close of 1919 the most decided increase in the cost of coal yet experienced has taken place, and the resultant effect on gas rates has been extreme. It is too early, as yet, to attempt to say what the operating ratio will be for the year 1920, but there is every reason to believe that it will be less favorable than for 1919.

The water utilities show an increase in the operating ratio from 51.45 per cent in 1914 to 64.46 per cent in 1919. Of the total cost of furnish-

ing water service, the return upon the investment is normally a larger proportion than in the gas and electric service. An operating ratio of 50 per cent to 55 per cent for all the water utilities in the state would probably be considered about normal, so that the effect of the increased cost has been to make the ratio of expenses to revenues very much higher than the normal ratio.

In the electric business the changes in operating ratio have not been as marked as in other lines of utility business. This is due, as already suggested, in part to the increase in volume of business, and it is due, in some part, also, to the hydroelectric developments which, to an extent, have freed the electric business from the effect of the increased cost of coal. Even in the electric business, however, there has been an increase in the operating ratio. In 1910, the ratio was 65.63 per cent, and in 1914, 65.42 per cent. In 1918 and 1919, the operating ratios were, respectively, 71.98 per cent and 71.44 per cent.

The telephone business up to the time of the war had an operating ratio of from 75 per cent to 77 per cent. In 1917 this increased to 81.42 per cent, in 1918 it was 83.92 per cent, and by 1919, 85 cents out of each dollar was required to defray operating expenses.

These increases in the ratio of expenses to revenues must be considered in connection with the increases in rates which many of the companies obtained. It will be noted, that in spite of a great many increases in rates, the public utility industry, as a whole, in the state, had a decidedly less favorable operating ratio in 1919 than its normal ratio prior to the war. Expressed in terms of the rate of return available the result of this is still more evident.

The only time that the gas utility, as a whole, in Wisconsin, has shown a return of more than 7 per cent on the book value of the property, was in 1916. In 1919, the rate of return for the industry was only 5.09 per cent. For the water business, the rate of return was only 4.25 per cent, but this must be considered in connection with the fact that most of the water plants in the state are owned by the municipalities, and in many cases the rate of return available has been a secondary consideration.

Like the gas business, the telephone business showed its greatest return in 1916 when a composite return of 7.5 per cent was earned. This dropped to 3.8 per cent in 1918, and in 1919 the earnings had improved so that there was a return of 4.8 per cent. This improvement in earnings was due, in part, to increases granted by this Commission, and in part to the toll rates placed in effect by the Postmaster General.

In 1916, the electric business of the state had a composite rate of return of 7.63 per cent, which declined to 4.82 per cent in 1918. The year 1919 showed a slight improvement, when a composite return of 5.43 per cent was earned. This improvement was due, in part, to increases authorized by the Commission, in part to increased business, and in part to somewhat lower coal prices affecting a few of the large companies.

The electric railways show most seriously the effect of increased costs. The year 1910 showed a return of 6½ per cent for the electric-railway

business of the state. The year 1914 showed a decrease to 5.6 per cent, and 1919 showed a return of only 1.9 per cent. Increased operating expenses, in practically every element with which the cost of railway service is concerned, were primarily responsible. The volume of business done in 1919, on the whole, was very good.

No attempt has been made in the above discussion of the rate of return to determine the relationship of the book values or plant accounts of companies as a whole, but the analyses given are of value for comparative purposes.

NUMBER OF UTILITIES

The number of utilities, of which the Commission has a record, increases each year. This is due, principally, to the increasing completeness of our records of the very small telephone utilities, generally known as roadway companies. These utilities, as a class, do not operate any switchboards, and are merely associations of farmers who secure their central-office service from some conveniently located telephone company.

The tendency toward consolidation in the electrical business tends to reduce the number of individuals operating utilities in this field. In presenting in this report a summary of the number of utilities in the state, we have not attempted to show the number of individual localities supplied with the different classes of utility service. For instance, the 324 electric utilities supply more than 324 communities. They represent, however, a total of 324 organizations engaged in the electrical business. Similarly, in the telephone business many of the companies operate more than one exchange, but the number of exchanges operated would not, in and of itself, be a measure of the telephone development, for the reason that a single exchange may serve in addition to the patrons directly supplied by the company owning it anywhere from 1 to 20 roadway companies. Consequently, it seems that the best practical way to show the number of utilities in the state is to show the number of organizations engaged in different lines of utility business. The following is a summary of this information divided as between municipally owned and privately owned utilities:

Summary of Utilities

As of June 30, 1920

Classification	Municipal	Private	Total
Electric	107	217	324
Gas	2	33	35
Water	121	26	147
Street railway	...	25	25
Heating	...	12	12
Toll bridge	...	8	8
Total utilities	230	321	551
Telephone	...	982	982
Grand Total	230	1,303	1,533

TRAFFIC DEPARTMENT

R. V. ADAMS

The activities of the Traffic Department of the Commission were, to some extent, curtailed by the Government operation of the railroads during the war, the Interstate Commerce Commission, acting for the President, assuming full control of traffic, both intrastate and interstate. Freight rates, rules and regulations covering transportation matters, were changed without notice to, or approval of, this Commission. While this procedure reduced the work of the Department in some ways, it increased it in others. Tariffs, naming freight, express and passenger rates, were filed by carriers for information only. Careful examination had to be made of them that reliable information could be given people of the state who requested it and whose interests were to be protected in every way possible.

During the period of Federal control the Commission has been required to take part in proceedings before either the Railroad Administration or the Interstate Commerce Commission for the protection of Wisconsin interests. Many of these matters were of wide importance to the entire state, such as the Northwest fuel order and the proposed double increase in freight rates on coal from Illinois and Indiana fields, and notably, Director General of Railroads McAdoo's Order No. 28 of June 25, 1918, providing, in part, that interstate class rates were to become effective on intrastate traffic. As the interstate rates were considerably higher than the Wisconsin intrastate rates, the Commission, represented by the Chairman and two rate experts from this Department, met with the Railroad Rate Committee in Chicago and were successful in having the Wisconsin intrastate rates retained. The same may be said regarding rates applying on different commodities. All of which were of great benefit to the people of the state. In all cases of major importance and having a large state-wide interest, the Commission has appeared and been heard in accordance with the provisions of the Statutes.

The Department office force, before the war, consisted of the Department head and three clerks. As activities decreased one clerk was dispensed with and has not been reinstated.

The tariff files contain, at the present time, 1,374 local freight tariffs naming intrastate Wisconsin rates, filed by railroads operating in Wisconsin, 850 tariffs naming Wisconsin interstate rates, 1,625 freight tariffs filed by railroads outside the state, 36 express tariffs, 219 steam-line passenger tariffs, 71 electric-line freight tariffs, 53 electric-line

passenger tariffs, 94 telegraph-line tariffs, making a total of 4,322 schedules naming rates, rules, regulations, etc., affecting railroads. Many of these tariffs name thousands of rates, many of them being corrected daily by supplements to the tariffs, which must be promptly filed that the correct rates in effect can be determined without delay.

The Wisconsin Statutes provide that freight or express bills may be submitted to the Commission for audit, no charge being made for such service. This privilege is apparently made little use of, as records show but 1,907 freight bills audited outside of the various departments of state; 88 claims for overcharge were filed for the shippers, with recovery of $762.18, during the period November 1, 1918, to November 1, 1920. For the different departments of state, 5,622 bills were audited, with recovery of overcharges amounting to $1,429.08, this for the period February 20, 1920, to November 10, 1920; February 20, 1920, being the date the departments of state began submitting freight bills for audit.

It will be seen from the above that files of the different freight-rate schedules must of necessity be complete and accurate.

The Commission, through this Department, has been giving considerable attention to the furnishing of empty cars by railroads to shippers for loading, the results being highly satisfactory to all concerned. Communications received daily bear out this statement.

Claims against carriers for loss or damage to property in transit are also given attention every day, with likewise good results. Although the jurisdiction of the Commission is limited by statute to making an investigation and report of its findings, in many instances our investigations indicate that claims for loss and damage are delayed by carriers through claim of non-receipt of necessary papers, or their entire loss by mis-carriage or carelessness in local or general offices. Such delays often extend beyond the statutory time of two years and one day allowed for court action for recovery.

Delays in handling claims presented to them for loss or damage by the carrier, we believe, should be given preferred attention, and adjustments made within a stated time, such time limit to be set by statute and penalty provided for failure to so adjust, and, further, in case such claims are declined by carriers and subsequent court action results in decision authorizing payment, a penalty should be imposed against defendant carriers for such an amount as considered advisable, but large enough to stimulate the proper adjustment of claims. We certainly believe such a law in this state would be of material assistance in eliminating a cause of just complaint by those who are unfortunate enough to have claims for loss or damage against the carriers.

Indications now point to a decided increase in the activities of this Department. Readjustment of traffic matters to meet changed conditions is well under way and is being given the most careful attention.

ENGINEERING DEPARTMENT

C. M. Larson

ORGANIZATION

The engineers serving the Railroad Commission are organized as the "Railroad and Utilities Division" of the State Department of Engineering. This Division not only performs such duties as may be assigned to it by the Railroad Commission, but its members are available for service to other State departments upon call by the State Chief Engineer. A report of all the activities of the Division is made quarterly to the State Chief Engineer. The Division is composed of a group of highly trained engineers and assistants, numbering, approximately, 27 men, as an average, for the two years. In addition, the Department employs a number of stenographers, clerks and other assistants. There are approximately 35 men in the employ of the Department who receive a nominal salary for reading gages showing the height of water in various rivers of the state.

While the greater portion of the time of members of this Division is taken up by the work of the Railroad Commission, a considerable number of assignments are made by the State Chief Engineer, under which work for other State departments is carried on by engineers especially qualified for the duties assigned.

SCOPE OF ACTIVITIES

The activities of the Engineering Staff may be classified, roughly, under two headings, namely, valuation of public utility property, and inspection or supervision of service rendered to the public by the utilities and the railroads. The members of the staff are assigned in most cases to either the valuation or the service work, though there is no sharp line of demarkation between the two, and all are employed more or less in both.

The actual work performed by members of the Department for the Commission depends upon a variety of conditions surrounding the particular case at hand, and may vary anywhere from a simple inspection to the holding of a formal public hearing or the preparation of a tentative formal decision.

The engineering activities will be presented briefly under the following headings, corresponding to previous reports:

A. Public Utility Service.
B. Railway Construction and Service.
C. Public Safety.
D. Physical Property Valuation.
E. Water Power.
F. Jitney Regulation.
G. Miscellaneous Engineering Matters.

A. PUBLIC UTILITY SERVICE

During the two years covered by this report, the labor and material markets have been such that it has been extremely difficult for utilities to maintain the standards of service which have been prescribed by the Commission. This condition has had some influence upon the kind and number of inspections made during this period.

For purposes of comparison the inspections of service are listed separately for the two years in the following paragraphs:

(1) Year Ended June 30, 1919

Routine Inspections.—During this period 576 routine and follow-up inspections were made, of which 51 were of gas service, 253 of electric service, and 272 of telephone service.

Formal Cases.—Formal cases handled were 25 in number, 3 of which were for gas service, 11 for electric service, 4 for electrolysis, 1 for street lighting, 4 for telephone service, and 2 for telephone extensions.

Informal Matters.—Investigations were made as follows: Three relating to water service, 11 relating to gas service, 25 to electric service, 14 to telephone service, and 1 relating to heating service. Referee tests were made on 3 gas meters, 6 electric meters, and 2 water meters. Thirteen matters of safety and interference were investigated, 3 of inductive interference, 2 of street lighting, 5 of electric extensions, 16 cases pertaining to farm lines, and 6 to fatal accidents.

Miscellaneous.—Two important electrolysis cases were handled, which are outlined below:

Beloit Electrolysis Case.—This formal case arose from complaint of the Beloit Water, Gas and Electric Company of damage sustained to its water and gas pipes from stray currents of the Beloit Traction Company and Rockford & Interurban Railway Company. Plans were made and approved for the installation of a negative insulated feeder system by the Rockford & Interurban Railway Company.

Milwaukee Electrolysis Case.—A detailed electrolysis survey was made in the city of Milwaukee, covering a period of approximately six weeks. This work was undertaken by the Commission in connection with a formal case then pending. This survey was made in cooperation with the Bureau of Standards at Washington, D. C., and each utility in Milwaukee owning either pipes, cables or street-railway tracks, participated in the investigation.

A very complete report was made of the conditions as found, and an order was then issued by the Commission creating a permanent elec-

trolysis committee for the city of Milwaukee with one of the Commission's staff as ex-officio member. This committee has charge of all electrolysis investigations, including the installation of mitigative measures, all under the supervision of the Commission, which retains complete jurisdiction.

Other miscellaneous matters included many special reports on service, rates, etc., including combined statistical and engineering analyses of rates and service. Heating rates and service were investigated in four cities. Water works matters, involving metering, extensions, adequacy of service, changes in rates, etc., were investigated in six cities and villages. Electric rates and service were investigated for the general lead- and zinc-mining district served by the Mineral Point Public Service Company, and for the territory served by the Burkhardt Milling and Electric Company.

A report and recommendations were made for the modification of Rule 17, and Order U.—233 (*In re Standards for Gas and Electric Service in the State of Wisconsin*), extending the time for making periodic tests of electric-service meters.

Standards Laboratory

The routine testing work of the laboratory for the year ended June 30, 1919, included the following: Twenty-five d-c. ammeters, 8 a-c. voltmeters, 11 d-c. voltmeters, 7 wattmeters, 56 a-c. watt-hour meters, 14 d-c. watt-hour meters, 3 voltage and 5 current instrument transformers, 11 insulating oils, 11 field tests, 17 special tests, 57 insulating papers, 50 meters at Avoca, 50 at Roxbury, and 6 at Evansville.

Special matters handled by the laboratory were as follows:

A study was made of the conformity of three Westinghouse Type "A" watt-hour meters to the requirements of the "Code for Electricity Meters."

An approved shipping case was designed for electrical meters and instruments, which permits the packing of meters for shipment so that they are protected against disturbance of calibration and permanent injury due to jars, shocks and rough handling in transportation. These cases are available to utilities and industries at cost.

A study of the characteristics of recent types of indicating demand meters was carried on with a view of obtaining information upon which the Railroad Commission might base rules for testing and maintenance. Thus far, one General Electric and two Westinghouse types have been studied.

The following investigations were completed:

(a) Twenty-four month tests of Sangamo, Type D—5 service watt-hour meters, both in laboratory and field.

(b) A study of the characteristics of the current transformer equipment of the Standards Laboratory.

(c) The development and construction of a sky-brightness attachment for the Sharp-Millar portable photometer.

(2) Year Ended June 30, 1920

Routine Inspections.—During this period 731 routine and follow-up inspections were made, of which 59 were of gas service, 319 of electric service and 353 of telephone service.

Formal Cases.—Formal cases handled were 29 in number, 16 of which were for gas service, 7 for electric service, 4 for telephone service, 1 for heating service, and 1 for gas-meter test.

Informal Matters.—Investigations were made as follows: Two relating to water service, 22 relating to gas service, 42 to electric service, and 58 to telephone service. Referee tests were made on 7 electric meters. Thirty-three matters of safety and interference were investigated, 4 of safety, 8 of inductive interference, over 115 of electric extensions, and 4 fatal accidents, and 1 telephone extension. Twenty-six sets of extension rules were approved, and practically all the calorimeter outfits of the different gas companies were checked with this Commission's standards.

Standards Laboratory

The routine testing work of the laboratory for the year ended June 30, 1920, included the following: Five a-c. ammeters, 6 d-c. ammeters, 6 ammeters not classified, 4 a-c. voltmeters, 5 d-c. voltmeters, 8 voltmeters not classified, 10 wattmeters, 58 a-c. watt-hour meters, 13 d-c. watt-hour meters, 2 current instrument transformers, 25 insulating oils, 28 special tests, 28 commercial field tests, and 3 commercial laboratory tests.

An unusual number of mastermeters were received from plants applying for calibration for the first time, and these meters showed larger errors than those that had been tested more frequently.

Two of the large utilities also arranged for scheduled testing of their demand and watt-hour meters at all sub-stations.

Special tests included tests on railway signaling equipment; one gas calorimeter outfit; thermometers and periodograph apparatus; insulating paper, and on high-tension expulsion-type fuses.

Digest of Service Conditions in the State for the Two Years

In order that the utilities might be able to determine how their own service compares with that of others in the state, various tables were prepared, covering different phases of the service. Supplementary to this each utility was also given a standing or rating.

These results, which have been summed up in the following paragraphs, were presented in the form of charts and displayed both years at the Annual Convention of the Wisconsin Gas and Electric Association at Milwaukee. Headquarters were maintained jointly with the Industrial Commission of Wisconsin by the engineers at the Hotel Pfister, where an exhibit of the service work of the Railroad Commission was shown.

The trend of gas service in the state is brought out by a comparison of conditions found on inspections for years ended June 30, 1918, 1919, and 1920. The average compliances with the Commission's service rules for these three years were 75.9 per cent, 77.1 per cent, and 73.3 per cent, respectively.

A study of the heating value of the gas as found by the Commission's inspectors gives some very interesting information on the relation that exists between the "Heat Content" of the gas and the present grade of coal and oil that the utilities are forced to use. For the year ended June 30, 1918, inspections of 14 water-gas plants showed the average heating value to be 610 B.t.u., while inspections of 13 coal-gas plants showed an average of 603 B.t.u. For the year ended June 30, 1919, the water-gas plants gave an average heating value of 593 B.t.u., and the coal-gas plants gave 582 B.t.u. These figures for the year ended June 30, 1920, are 584 and 580 B.t.u., respectively, showing a gradual decrease in the heating value of gas produced by both kinds of plants.

As regards gas-meter testing, figures show that for the year ended June 30, 1918, 8.2 per cent of the meters in use in the state were overdue for test for the year ended June 30, 1919, 8.3 per cent, and for the year ended June 30, 1920, 11.7 per cent. The large increase in meters overdue for test in the last year is due, in part, to the large increase in gas consumers, which results in the necessity for a large number of installation tests. The number of gas consumers for the year ended June 30, 1919, increased by 2.4 per cent over that for the previous year, while the annual increase for the year ended June 30, 1920, was 6.1 per cent.

The average standings for electric utilities for the years ended June 30, 1918, 1919, and 1920, respectively, are 76.1 per cent, 75.4 per cent, and 76.2 per cent. It would naturally be expected that the Commission's order of November 1, 1918, extending the time-interval between periodic tests of meters would tend to raise the average standing of utilities. This probably would have been the case, but other points in service have been affected to such an extent by lack of help and material that the average standing went down during 1919.

On June 30, 1920, the Service Department had under its jurisdiction about 480 communities receiving electric service, an increase of about 45 over the preceding year, and during the year immediately preceding that time, 320 of these were given a routine inspection.

During the period covered by this report, 23 new companies have been organized to furnish electric service in the state.

Figures show that for the year ended June 30, 1920, users of electricity numbered about 243,000, which represents an increase of about 15 per cent over the preceding year.

The average standing for telephone utilities for the two years ended June 30, 1920, was 78.5 per cent, which is somewhat lower than the 79.5 per cent for the year ended June 30, 1918. This is very largely due to the shortage of equipment, a shortage of operators on account

of sickness, especially during the influenza epidemics, and an unusual demand for service, both in increased traffic and a larger number of stations.

Telephone subscribers in the state number about 347,000, with a total of about 705 exchanges, including a large number of switches; 449 of these were inspected in the two years ended June 30, 1920.

Figures for exchanges which were inspected, both in 1918 and in 1920, show that the subscribers' stations have increased about 17 per cent in two years.

Rural Electric Extensions

The increasing demands for rural extensions of electric lines have made it necessary that some definite plan be worked out for the guidance of the electric utilities of the state.

Rural residents need the electric service, and it should be extended to them with safe construction and with assurance of continuity.

The Service Department has made a rather complete study of the operating conditions of the representative farm lines of the state. This shows that the revenues that can be obtained from rural consumers, if based upon urban rates, is not sufficient to maintain good service. Among the causes for this are the excessive construction cost per consumer, the cost and difficulty of keeping the lines in repair, and the heavy line losses attending this service.

The history of the development of the rural telephone lines, with the lack of proper provision for maintenance and replacement, gives some idea of what may be expected of the rural electric lines if the same plan is followed.

With a view of working out some rules which would make rural extensions feasible, and at the same time safeguard the operating companies as well as the customers, the engineers of the Commission have been encouraging a thorough study of the entire subject by the utilities. This has resulted in the appointment of a committee by the Wisconsin Electrical Association, which, after careful consideration, has submitted a proposed set of rural-extension rules, which have been accepted by several of the larger operating companies, and filed by them with the Commission.

Miscellaneous.—Reports have been made on the power situation at the following places: Packwaukee, Endeavor, Winneconne, Shawano, and Holman.

The Service engineer attended a conference at Indianapolis, where rules for gas service were under consideration, and a thorough discussion was had of all phases of this subject, especially pertinent at this time because of the fuel situation.

B. RAILWAY CONSTRUCTION AND SERVICE.

1. Electric Railway Construction

During the two years covered by this report, work of a greater or less magnitude has been carried on relative to extensions of street-car lines (prospective or actual) in Manitowoc, Beloit, LaCrosse, Superior, Madison, Racine, and Milwaukee.

Plans have been checked and approved for city bridges carrying street-car tracks in Beloit, West Allis, Racine, Menasha, and Fond du Lac, and apportionments of costs recommended.

Plans for certain new equipment have been considered and approved for use in Milwaukee, Racine, LaCrosse, Green Bay, Oshkosh, Beloit, and Madison, and for the Chicago, North Shore & Milwaukee Railway. Some of this equipment has also been inspected.

2. Steam Railway Construction

Because of war conditions there has been little railroad construction in this state during the two years covered by this report.

Work has been performed by this Department with reference to the construction of the extension of the Wisconsin & Northern Railroad from Black Creek to Appleton (16 miles), and approving same for operation, which was begun in January, 1919. An inspection of location and approval thereof was made for the same company for its proposed extension from Appleton Junction to Neenah (5⅓ miles) in connection with its application for a certificate of convenience and necessity.

Plans have also been checked and approved for the grade separation at Main street, Kenosha, being the first part of the general grade separation with the Chicago & North Western Railway tracks in that city to be started, which work was finally ordered by this Commission on July 11, 1919.

In a similar manner plans have been handled for the North Avenue grade separation with the Chicago, Milwaukee & St. Paul Railway in Milwaukee by means of a reinforced concrete viaduct, which work was ordered by the Commission on May 1, 1917, but delayed by reason of war conditions.

An inspection of the Ettrick & Northern Railroad line (10 miles) was made in November, 1918, and recommendation made that permit to operate be granted.

In the spring of 1920 a verbal report was made relative to a small stock issue to cover preliminary engineering expenses requested by a company proposing to construct a line of railroad between Madison and Portage.

Some work has also been done in connection with the application of the Milwaukee Connecting Railway Company (about 10½ miles), but construction has not yet been started because of war conditions.

3. Electric Railway Service

Work of considerable magnitude has been performed under this heading, covering such matters as operating rules, electrolysis, car schedules, skip-stops, track and equipment maintenance, fare zones, transfers, loading points, routing of cars, traffic studies, and strength of bridges. In addition to a large volume of work covering routine and purely informal matters, work has been performed for 30 formal cases of this character which have been before the Commission.

A large amount of routine work is constantly being performed from the Milwaukee office in connection with city and interurban car-service in and about Milwaukee.

4. Steam Railway Service

Work has been performed under this heading in connection with station facilities, side-tracks, industry spurs, restoration of industry spur tracks following the "south side" grade separation in Milwaukee, train schedules, service and connections, switching and freight service, interchange or connecting tracks, stock-yard facilities, right-of-way fences, private or farm crossings, and express service. The item of station facilities includes questions of employment of agents and operators, inadequate waiting rooms, freight rooms and heating rooms for perishable freight and express, new depots and platforms, union depots, insanitary toilets, poor lights, and inadequate heating, and the keeping of stations open for service.

Most of this work has been in connection with informal complaints, but also covers 31 formal cases which have been before the Commission.

Passenger-train delay reports are being required of the nine principal railroads operating in the state. These daily reports are classified, tabulated, and compiled into a monthly report, showing for each road, and for all roads combined, the total number of passenger trains run, the number of trains late, percentage of trains late and the average time late per train run. The last two items are also compared with similar items for the same month of the preceding year. The causes of delays are classified under 15 headings. Copies of this monthly compilation are sent to various railroad officials and other persons interested. Considering all the roads combined, the greatest delays seem to occur in the month of January, and the least in May. March is also a bad month for delays. The greatest number of delays are caused by waiting for connections with trains from other divisions or other railroads. The next greatest source of delay is station work. Generally, the next contributing causes in order of number of delays are meeting and passing trains, trains ahead, engine and equipment failures, and weather conditions. The condition of track is responsible for only a very small percentage of the delays. Trains arriving late at connection points are themselves generally delayed, as otherwise stated above, so that station work may be considered to be the primary source of passenger-train delays. The excessive station work is being caused

by the increasing amount of baggage, express and milk shipments offered for transit on passenger trains. The milk and express business, in particular, is becoming a serious hindrance to passenger-train service.

C. PUBLIC SAFETY

1. Block Signals and Interlocking

A little less than one half of the railroad-line mileage of the state is protected by block signals. Of this block-signal mileage only 1,200 miles (about one sixth of the line mileage) are protected by automatic signals. This Department has been giving some thought to the matter of automatic train control but, in line with the general sentiment of students of this problem, believes that automatic train control, if installed, should operate with automatic signals. Active influence, therefore, is first being exerted to increase the use of automatic signals. The Railroad Commission has used its influence to secure the installation of automatic signals, and required that the railroads submit plans for same for approval. From this has grown the present recognized practice of submitting all plans for new automatic signals and circuits, or changes to be made in existing signals and circuits, to the Commission for approval. It has also been the practice of this Department to inspect such new installations before same are put into service.

No new automatic signals have been installed during the two years ended June 30, 1920. Plans showing proposed changes in automatic-signal circuits are constantly being received and checked for approval. These changes are caused by changes in switches, installation of automatic crossing protection and for various other reasons.

There are 109 interlocking plants in the state, protecting various railroad crossings, junctions, and drawbridges. Twenty-eight of these plants are in the Milwaukee territory, 23 in Superior and vicinity, and the remainder are scattered over the balance of the state.

These plants are constructed, maintained and operated under rules adopted by the Railroad Commission, effective December 1, 1913, and the railroads make regular monthly and quarterly reports covering each plant upon forms furnished by the Commission. Prior to October, 1919, all of these plants were regularly and carefully inspected by this Department at least once, and generally twice, a year. Since that date, this work has not been done with that regularity nor thoroughness. This Department receives many plans for proposed alterations, renewals and reconstruction of plants, and this feature of the work is all being handled promptly.

2. Grade Crossings

(a) *Railroads with Railroads.*—The principal work of public interest under this heading is the investigation started by the Commission early in 1920, relating to safeguarding traffic at crossings of tracks of steam and electric railroads. A joint committee, consisting of three

members appointed by the Wisconsin Electrical Association to represent the electric roads, and three members selected by the steam roads to represent them, now has this matter in hand. This Department is now collecting data for the use of that committee.

(b) *Streets and Highways with Railroads.*—This phase of the work is constantly growing in importance because of the increasing density of highway traffic, due to the large number of automobiles now in service. For this reason an engineer was employed in November, 1919, primarily to work on crossing matters. A revised list of all railroad crossings is being made from right-of-way and track maps now being received from the railroads. Each crossing is given a form card, and the data called for is inserted so far as it is known or acquired. A note of all accidents reported on the crossing is made as the report is received.

Field investigations are constantly being made and reports written thereon. Plans for automatic protective devices are checked for approval. A great deal of such work is in connection with informal complaints, but during the period of this report work was performed for 45 formal crossing cases before the Commission.

Several of these formal cases involved grade separation by means of subways or viaducts, or elimination by means of highway relocation.

As many new crossings are being opened up every year, it would be desirable if there were statutory requirement that the Railroad Commission be informed at once by both railroad company and by the town or municipal authorities whenever any new crossing is opened, or when any old crossing is vacated, changed in form or manner of protection. In fact, it would be preferable to require the Commission's approval before such action could be taken.

A carefully prepared poster illustrating the several warning signs and protective devices used at grade crossings in this state has been prepared and distributed for posting in garages, railroad stations, hotels, and other convenient places in all parts of the state.

The following improvements to highway and street crossings with railroad tracks have been ordered or approved during the two years covered by this report:

1. The installation of bells or wig wags at	30	crossings
2. The installation of flagmen at	2	"
3. The installation of gates at	2	"
4. The improvement of approaches or the removal of obstructions to view at	18	"
5. The elimination of 8 grade crossings, by closing	6	"
By viaducts or overhead bridge	2	"
6. The opening of 5 new crossings, at grade	3	"
By overhead bridge	1	"
By underhead, or subway	1	"
7. The diversion of highway traffic from	13	"
8. The making of miscellaneous improvements at crossings already provided with some form of protection at	27	"
Total public crossings affected	105	crossings

Herewith are listed the grade-crossing accidents as reported by the railroads under Interstate Commerce Commission Rules:

	1918-1919		1919-1920	
By the steam roads:				
Total Number of Accidents Reported........	....	203	....	153
	Killed	Injured	Killed	Injured
Total Casualties—Unprotected Crossings...	44	139	32	114
" " —Bell Crossings'...........	11	16	16	15
" " —Flag "	5	20	4	30
" " —Gates "	9	21	6	26
" "	69	196	58	185
By the electric interurbans:				
Total Number of Accidents Reported........	....	4	....	5
Total Casualties—Unprotected Crossings	6	1	....	1
" " —Bell Crossings.........	....	....	2	3
" " —Flag "	2	3	....	....
" " —Gates "	....	....	....	....
" "	8	4	2	4

Based upon reports received, there was an improvement in 1919–1920 over 1918–1919 as regards grade-crossing accidents. There are approximately 9,600 grade crossings in this state.

3. Railroad Accidents

Accident reports are required from both steam and electric roads, each month, on forms furnished by the Commission, and in accordance with the rules of the Interstate Commerce Commission governing accident reports. In addition thereto, the roads are expected to make a current report of each accident by letter or wire.

All the totals given below include the grade-crossing accidents heretofore listed and the casualties to trespassers given below. The figures for 1918–1919 include only the steam roads. Those for 1919–1920 cover both steam and electric roads. These compilations have been made from the monthly accident reports received on regular forms.

Steam Roads, 1918–1919

(a) Non-train accidents			3,101
Employes, ...	killed, 3;	injured, 3,051	
Non-employes	" 3;	" 44	
(b) Train and train-service accidents..................			1,693
Employes	killed, 40;	injured, 936	
Non-employes	" 142;	" 353	
Totals	killed, 188;	injured, 4,384	4,794

Included in the above figures are 68 trespassers killed and 52 injured.

Steam Roads, 1919–1920			
(a) Non-train accidents			2,202
Employes	killed, 4;	injured, 2,153	
Non-employes	" 2;	" 43	
(b) Train and train-service accidents			2,009
Employes	killed, 30;	injured, 1,174	
Non-employes	" 116;	" 468	
Totals	killed, 152;	injured, 3,838	4,211
Electric Roads, 1919–1920			
(a) Non-train accidents			210
Employes	killed, 3;	injured, 207	
Non-employes	" ..	" ..	
(b) Train and train-service accidents			1,148
Employes	killed, 3;	injured, 41	
Non-employes	" 29;	" 1,444	
Totals	killed, 35;	injured, 1,692	1,357
Grand Totals	killed, **187**;	injured, **5,530**	**5,568**

Included in the above figures are 53 trespassers killed and 20 injured.

4. GRADE CROSSING ELIMINATION SUBWAYS AND VIADUCTS

Work in connection with the order for future grade separation through Shorewood and for the final order for grade separation by means, mainly, of track elevation through Kenosha, was completed during the period covered by this report. Several eliminations of crossings by means of viaducts, subways or relocation of highways are included in other parts of this report.

5. TRACK INSPECTION

About 2,800 miles of track covering all the principal lines in all parts of the state were inspected from rear ends of trains in the fall of 1918 for the Director General of Federal Railroads at his request, and a report made to him.

6. BRIDGES

Field inspection and calculation of stresses of the 27th-street viaduct in Milwaukee have been made.

The safety gates mentioned in our report of June 30, 1918, as having been installed at the draw in the Main-street bridge over Fox river at Green Bay have been refused by the city, and the contractor ordered to remove same. The city has not, as yet, submitted other plans for the Commission's approval.

7. FENDERS

Plans for fenders or life guards have been examined and approved for use on street cars in Ashland and Hurley.

WISCONSIN STATE ELECTRICAL CODE

In November, 1919, the necessity for revising Order No. 662, covering standards for the safe construction and operation of electric systems, was determined.

An advisory committee was appointed to consult with members of the staff of the Railroad Commission and the Industrial Commission. This committee is composed of representatives of the various interests affected by the code, the personnel being as follows:

Mr. Thomas Broughton, State Insurance Inspection Department,
Mr. Paul C. Burrill, Electrical Contractor,
Mr. F. R. Daniels, Wisconsin Inspection Bureau
Mr. Geo. C. Cooper, Milwaukee Manufacturers Association,
Mr. Fred Gratz, Federation of Labor,
Mr. F. H. Runkel, Independent Telephone Association,
Mr. W. D. Hobbins, Wisconsin Telephone Company,
Mr. W. H. Haig, City of Milwaukee.

Others have been called in from time to time to furnish information on special matters. Frequent meetings have been held, and the work of compiling a new code is progressing satisfactorily. Meetings are now being held weekly with the idea of hastening the completion of the work.

Warnings of High Voltage.—Chapter 547, Laws of 1919 (Section 1808*b* of the Statutes), requires utilities to place a warning sign on all poles and structures supporting wires having a voltage of 6,000 volts or more. It also requires the Commission to provide stencils for this purpose, to be supplied to such utilities at cost. Such stencils, to the number of, approximately, 100 have been supplied as required.

D. PHYSICAL PROPERTY VALUATION

The making of valuations of physical property has been rendered exceedingly difficult because of the unprecedented rise in prices affecting all material and labor used in utility-plant construction.

In making an appraisal of property it is essential that fair and reasonable treatment be given the utilities in order that they may be enabled to render adequate service to the public, while it is equally important that the public interests be safeguarded against unreasonable exactions in rates.

Because of the abnormal fluctuations in prices, it has become necessary to modify methods of making appraisals, to some extent, and to spend much more time upon investigations along unusual lines than was formerly necessary. This has added materially to the engineering costs of performing this work.

Furthermore, the increasing costs of operation have forced many utilities to apply for relief in higher rates, thus adding further to the number of valuations that the Department has been called upon to produce.

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The projects of greatest magnitude performed during the period covered by this report were the valuation of the property of the Wisconsin-Minnesota Light and Power Company for rate and securities purposes, the valuation of the gas and electric properties of the Superior Water, Light and Power Company for purchase by the city of Superior, and the valuation of all property of the Wisconsin Gas and Electric Company.

In the following table are given the total number of utility properties appraised, together with the total amount found for cost of reproduction of such properties as were appraised carefully and in detail.

UTILITY PROPERTIES APPRAISED DURING THE TWO-YEAR PERIOD

FOR RATES OR PURCHASE

Kind of Property	Number	Reproduction Cost	No. of Approximate Appraisals
Electric	16	$816.084	17
Gas	4	1,013,415	0
Telephone	33	651,179	12
Water works	3	1,456,457	1
Combined (rendering more than one kind of service)	12	4,705,182	11

The above appraisals were not all made with an equal degree of exactness. Some were merely hurried investigations requiring only a short period of time by one man, while others were made in great detail requiring months of time of several men.

STEAM RAILROAD PROPERTIES

No valuations of steam-railroad properties have been attempted during the period, but approximate checks have been made of reports received from the Division of Valuation of the Interstate Commerce Commission. During this period the Division of Valuation has completed tentative reports on the appraisal of several of the railroads in the state, and copies have been received by this Department. Comparisons have been made with such information as was available in the files of the Commission, and conferences and correspondence with the Commission of a neighboring state, concerning the subject, have been carried on. This Department is keeping in close touch with the Chicago office of the Division of Valuation in order to keep informed as to the methods employed and the care exercised in making these appraisals. This Department is also rendering assistance to, and cooperating with, the Division in all cases possible.

E. WATER POWER

The engineering work in connection with water-power matters is naturally divided into two general branches. These are, (1) Stream Gaging, (2) Investigation of Dams and Flowage.

1. Stream Gaging

This work is still being conducted in cooperation with the Water Resources Branch of the United States Geological Survey, and is in immediate charge of a district engineer furnished by the Survey.

During the period covered by this report, 305 current-meter measurements of river discharges were made, and all data relating to the discharge of the rivers for the water years ended September 30, 1918 and 1919, were compiled and sent to Washington for publication in the United States Geological Survey Water Supply Papers.

At the end of this period the gaging stations shown in the following list were in operation; two stations having been abandoned and a new one added during the two years.

List of Gaging Stations on June 30, 1920

River	Location (Nearest Town)	Date of Installation	Type of Gage
Apple	Somerset	Jan. 1, 1901	Power Plant
Bad	Odanah	July 30, 191[illegible]	Automatic
Baraboo	Baraboo	Dec. 18, 1913	Chain
Big Eau Pleine	Stratford	July 23, 1914	Sloping
Black	Neillsville	Dec. 11, 1913	Chain
Chippewa (below B. Fork)	Winter	Feb. 23, 1912	Staff
Chippewa	Bruce	Dec. 31, 1913	Chain
Chippewa	Chippewa Falls	Apr. —, 1899	Automatic
Eau Claire (Chippewa Dr.)	Augusta	July 16, 1914	Chain
Eau Claire (Wisconsin Dr.)	Kelly	Jan. 1, 1914	Chain
Embarrass	Embarrass	June 5, 1919	Chain
Flambeau	Butternut	July 30, 1914	Staff
Flambeau	Ladysmith	Jan. 2, 1914	Chain
Fox	Rapid Croche Dam	Mar. 3, 1896	Power Plant
Fox	Berlin	June 9, 1917	Staff
Jump	Sheldon	July 22, 1915	Chain
Kickapoo	Gays Mills	Dec. 25, 1915	Chain
Kinnickinnic	River Falls	Dec. 25, 1915	Automatic
La Crosse	West Salem	Dec. 22, 1913	Chain
Little Wolf	Royalton	Jan. 13, 1914	Chain
Menominee	Rapids Power Co.	July 1, 1913	Power Plant
Milwaukee	Milwaukee	Apr. 30, 1914	Chain
Namekagon	Trego	Mar. 23, 1914	Staff
Oconto	Gillett	Jan. 7, 1906	Chain
Pecatonica	Dill	Feb. 9, 1914	Staff
Peshtigo	High Falls	Aug. —, 1912	Automatic
Pike	Amberg	Feb. 26, 1914	Chain
Pine	Florence	Jan. 22, 1914	Chain
Plover	Stevens Point	Jan. 5, 1914	Staff

List of Gaging Stations on June 30, 1920 (Continued)

River	Location (Nearest Town)	Date of Installation	Type of Gage
Prairie	Merrill	Jan. 17, 1914	Chain
Montreal (East Br.)	Ironwood, Mich.	Apr. 23, 1918	Chain
Montreal (West Br.)	Gile, Wis.	Apr. 26, 1918	Slope
Red Cedar	Colfax	Mar. 19, 1914	Chain
Red Cedar	Cedar Falls	Apr. 1, 1909	Staff
Red Cedar	Menomonie	May 9, 1913	Automatic
Rock	Afton	Feb. 5, 1914	Chain
Sheboygan	Sheboygan	June 30, 1916	Chain
St. Croix	Swiss	Mar. 20, 1914	Staff
Sugar	Brodhead	Feb. 7, 1914	Chain
Tomahawk	Bradley	Sept. 18, 1914	Chain
Trempealeau	Dodge	Dec. 13, 1913	Chain
Waupaca	Weyauwega	June 28, 1916	Chain
Wisconsin	Rhinelander	Dec. 1, 1905	Automatic
Wisconsin	Merrill	Nov. 7, 1902	Automatic
Wisconsin	Nekoosa	May 22, 1914	Automatic
Wisconsin	Muscoda	Dec. —, 1902	Chain
Wolf	Kesheha	May 9, 1907	Staff
Wolf	New London	May 1, 1899	Staff

2. INVESTIGATION OF DAMS AND FLOWAGE

Dam Inspections.—Many dams have been inspected under the provisions of Section 31.19 of the Statutes, requiring the annual inspection of dams having a theoretical horse power of 750 or over.

Bench Marks.—Permanent bench marks were established at about 300 dams during the period, and in each case a survey of the dam was made and all important features noted and referenced to the bench mark.

This work was started several years ago but not much progress was made prior to the period covered by this report.

It is hoped that bench marks may be established at every dam in the state in the near future, as their establishment will greatly reduce the number of complaints coming before the Commission, and make it much easier to make a correct determination in cases that are brought before the Commission.

Permits to Build Dams.—During the period covered by this report investigations were made and permits granted for the construction of dams by the following companies:

Little Wolf Power Co. on Little Wolf river	21	foot	head
Chas. Topf and others on Embarrass river	32	"	"
E. T. Schneider and others on Red Cedar river	19	"	"
Ironwood & Bessemer Ry. & Lt. Co. on Montreal river	124	"	"
Belleville Electric Co. on Sugar river	10	"	"
Dahlberg, et al. on Yellow river (Burnett Co.)	20	"	"
Peshtigo Pulp and Paper Co. on Peshtigo river	25	"	"
C. W. Colt on Yellow river (Wood Co.)	25	"	"
Peninsular Power Co. on Menomonee river	60	"	"

Investigation made and permit pending:

T. N. Okerstrom et al. on Iron river .... 75 foot head

Permits to Raise Dams.—Investigations were made, and permits granted, for raising dams as follows:

Willow Lumber Co. on Namekagon River
Rose Milling Co. on Pine River
West Bend Woolen Mills on Milwaukee River
Union Manufacturing Co. on Oconto River
Jackson Milling Co. on Wisconsin River
Union Falls Mfg. Co. on Oconto River

3. FLOWAGE AND MISCELLANEOUS INVESTIGATIONS

About 20 formal cases were handled under this subject during the two years, and in addition a great many informal complaints or applications have received attention. Most of these have been in the nature of complaints of riparian owners concerning flooding of lands, either back water from dams, or otherwise. Others are complaints of low water above dams.

Many of the investigations were made because of complaints concerning the regulation of the flow of water, safety of dams, illegal construction of dams, interference with navigation, killing of fish or obstruction to free movement of fish.

F. JITNEY REGULATION

Owing to the greatly increased cost of gasoline, oil, tires and repairs for automobiles, and to the large wages being paid for labor by industries, the number of bonded carriers operating in the state has decreased considerably during the past two years. In the city of Milwaukee alone the number has decreased from 121 in July, 1918, to 42 in June, 1920. Similar decreases have occurred in Racine and Kenosha.

The number of bonded carriers authorized to operate at the close of the period covered by this report is shown in the following list:

Milwaukee	42
Racine	5
Kenosha	3
Remainder of the state	26

In Kenosha, several busses are being operated by the street-railway company supplementing its street-railway service.

G. MISCELLANEOUS ENGINEERING MATTERS

In the above report no attempt is made to enumerate the immense number of informal investigations of a minor nature which are continually presented to the engineers for consideration. Numerous requests for advice and assistance are received from cities, villages and towns, as well as from utility operators, and it is the policy of the Department to comply with such requests in all cases where practicable. The attention given to such matters requires a very considerable portion of the time of several members of the Engineering Staff.

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During the early part of the period covered by this report, the Engineering Department rendered considerable assistance to various Federal departments, especially the United States Fuel Administration and the Power Section of the War Industries Board. Of the investigations made, the two following are mentioned as being the most important:

A very extensive study was made, and a report submitted to the Federal authorities, on the feasibility of developing additional water power in the northern part of the state for distribution to Minneapolis, St. Paul, and adjacent territory.

Another report was made to the same authorities dealing with the fuel efficiency of steam stations, and the labor necessary to mine and transport coal.

Both of the above reports were very exhaustive and required a great deal of time for preparation.

At the request of the Interstate Commerce Commission an investigation was made of the actual condition of the property of the Fairchild & North-Eastern Railroad, difficulty in beginning operation having been experienced when this road was released by the United States Railroad Administration and turned back to the owners.

No mention is made in this report of work performed by the Railroad and Utilities Division for State departments, other than the Railroad Commission.

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